Professor Revaz R. Dogonadze (1931-1985)

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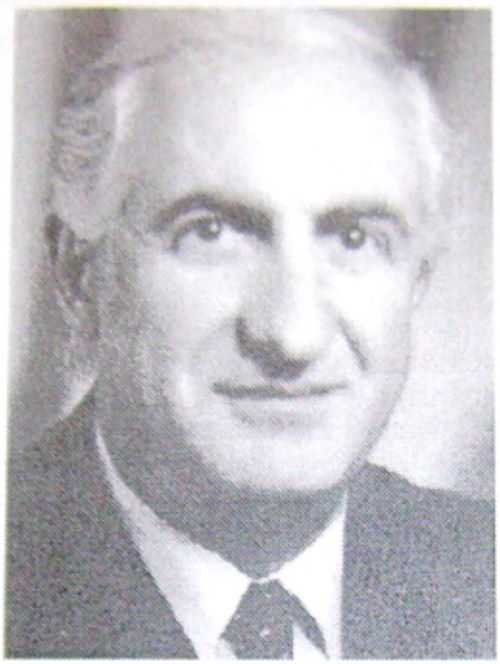

Member of the Georgian Academy of Sciences, Doctor of the Physical and Mathematical Sciences, Professor Revaz (Rezo) R. Dogonadze (1931-1985) was one of outstanding scientists in the modern Physical Chemistry, one of founders of the new science - Quantum Electrochemistry, main author of the Quantum-Mechanical Theory of the Kinetics of Elementary Act of Chemical, Electrochemical and Biochemical Processes in Polar Liquids.

Revaz Dogonadze was born on November, 21, 1931, in Tbilisi (Republic of Georgia). His father Roman I. Dogonadze (1905-1970) was a Professor of Economics of Agriculture.

1949-1955 - Student of the Moscow Physics-Engineering Institute.

1955-1958 - Post-Graduate Student of the Moscow Institute of Physical Chemistry.

1958-1978 - Research Fellow (1958-1962) and Senior Research Fellow - Head of the Group (1962-1978) of the Theoretical Department of the Moscow Institute of Electrochemistry.

1961 - Revaz Dogonadze obtained the Ph.Dr. degree, in 1966 - the degree of Doctor of the Physical and Mathematical Sciences (Dr.Sci.).

1962-1973 - Associate Professor (1962-1969) and Professor (1969-1973) of the Moscow State University.

1968-1985 - Member of the International Society of Electrochemistry

(ISE).

L.I. Krishtalik and R.R. Dogonadze

1978-1985 - Chairman of the Department of Electrochemical Physics and Member of the Board of the International Society of Electrochemistry.

1978-1985 - Founder and Head of the Department of Theoretical Investigations of the Institute of Inorganic Chemistry and Electrochemistry of the Georgian Academy of Sciences (Tbilisi).

1983 - Prof. Revaz Dogonadze was elected as Member of the Georgian Academy of Sciences.

1983-1985 - Head of the Department of General and Theoretical Physics of the Georgian Technical University (Tbilisi).

Revaz Dogonadze was the first scientist to view a chemical electron-transfer process as a quantum-mechanical transition between two separate electronic states, induced by weak interactions between the molecular entities represented by the states. One of the most important results of this investigations was recognition of the importance of nuclear tunneling, and that chemical processes should occur even at the lowest temperatures. The Theory was published during the years 1959-1961.

In the 1970's, a number of scientists of the Moscow Institute of

Electrochemistry joined the group of Prof. Revaz Dogonadze to collaborate on the problems of an elementary act of chemical reactions and charge transfer in chemical processes. A number of scientists from various countries (USA, Denmark, Germany) came to Moscow to work with Prof. Dogonadze. Thus, a scientific school of Quantum Electrochemistry was formed around him.

Along with the investigation of chemical reactions, Revaz Dogonadze also engaged in the study of light absorption by ions and molecules in solutions, photochemical reactions, biochemical reactions, low-temperature chemical reactions. These investigations were a significant contribution to the Theoretical Physics. He was co-author of the Quantum-Mechanical Model of Enzyme Catalysis.

In 1977 Prof. Revaz Dogonadze was Editor of the Russian edition Prof. R. Bell's monograph "The Proton in Chemistry" (Publishing House "Mir", Moscow, 1977, 381 pp.) and co-author of its appendix (E.D. German and R.R. Dogonadze. "The Quantum-Mechanical Theory of the Kinetics of Proton Transfer Reactions", pp. 350-376).

During the autumn of his life, he became interested in the non-traditional methods of investigating interface, the electrodynamics of interfaces and the processes of vibrational relaxation.

Prof. Revaz Dogonadze's final major undertaking, witnessed by an international audience, was the organization of the International Conference "Electrodynamics and Quantum Phenomena at Interfaces" (October 1-6, 1984, Telavi, Republic of Georgia), which was one of the most important events in Electrochemical Physics.

J. Ulstrup and R.R. Dogonadze

Prof. Dogonadze was Co-Editor and co-author of a three-volume collective monograph "The Chemical Physics of Solvation" (Elsevier, Amsterdam, 1985-1986).

On the evening of May 13, 1985, the distressing news reached the world's scientific community that had died Professor Revaz Dogonadze. He was only 53 years old.

Professor Dogonadze was author about 200 scientific works (among them 7 monographs). Under the guidance of R. Dogonadze were prepared 18 theses (13 Ph.Dr. and 5 Dr.Sci.).

The International Journal "Electroanalytical Chemistry and Interfacial Electrochemistry" dedicated to Prof. Dogonadze's memory a special issue (Vol.204, 1986). The detailed notices were published in the Journals "Progress in Surface Science" (Vol.20, Number 1, 1985), "Elektrokhimia" (Moscow, vol. XXII, 1986), "Bulletin of the Georgian Academy of Sciences" (Vol.119, Number 1, 1985) and other issues.

Founded by Prof. Revaz Dogonadze department of Theoretical Investigations of the Institute of Inorganic Chemistry and Electrochemistry of the Georgian Academy of Sciences carried his name after 1986.

In 1986 and 1989 in Tbilisi and Batumi were held the International Conferences "The Kinetics of a Charge Transfer in the Homogeneous and Heterogeneous Systems" dedicated to Prof. Dogonadze's memory.

SOME MAIN SCIENTIFIC WORKS OF PROFESSOR REVAZ R. DOGONADZE:

1. R.R. Dogonadze and A.M. Kuznetsov. "Contemporary State of the Theory of Electrode Processes". Publishing House of VINITI, Moscow, 1969, 95 pp. (a monograph. In Russian);

2. R.R. Dogonadze and Z.D. Urushadze. "Semi-classical Method of Calculation of Rates of Chemical Reactions Proceeding in Polar Liquids". J.Electroanal.Chem., 32 (1971), pp. 235-245;

3. R.R. Dogonadze and Z.D. Urushadze. "Investigation of the

Electrochemical Processes on the border of division Electrolite-Biological Membrane".- Dep. VINITI (No 3633-71), Moscow, 1971, 19 pp. (In Russian);

4. M.V. Volkenshtein, R.R. Dogonadze, A.K. Madumarov, Z.D. Urushadze and Yu.I. Kharkats. "Theory of Enzime Catalysis". Mol.Biol., Moscow, 6 (1972), pp. 431-439 (In Russian);

5. M.V. Volkenshtein, R.R. Dogonadze, A.K. Madumarov, Z.D. Urushadze and Yu.I. Kharkats. "Electronic and Confirmational Interactions in Enzymic Catalysis".- Konformatsionnye Izmenenia Biopolim. v Rastvorakh. Publishing House "Nauka", Moscow, 1973, pp. 153-157 (In Russian);

6. R.R. Dogonadze. "Theory of Chemical Reactions in Polar Liquids". Publishing House "Znanie", Moscow, 1973, 65 pp. (a monograph. In Russian);

7. R.R. Dogonadze and A.M. Kuznetsov. "Results of Science and Technology. Physical Chemistry. Kintics.", Vol. 2: "Kinetics of Chemical Reactions in Polar Solvents". Publishing House of VINITI, Moscow, 1973, 209 pp. (a monograph. In Russian);

8. R.R. Dogonadze and A.M. Kuznetsov. "Theory of Charge Transfer Kinetics at Solid-Polar Liquid Interfaces". Prog.Surf.Sci., 6 (1975), pp. 1-42;

9. R.R. Dogonadze, Z.D. Urushadze and V.K. Khidureli. "Calculation of the Kinetic parameters of the reactions accompanished with the Conformational Transformations."- Konformatsionnie izmenenia Biopolimerov v Rastvorakh. Publishing House "Metsniereba", Tbilisi, 1975, pp. 368-375 (In Russian, English summary);

10. R.R. Dogonadze, A.M. Kuznetsov and J. Ulstrup. "Conformational Dynamics in Biological Electron and Atom Transfer Reactions". J.Theor.Biol., 69 (1977), pp. 239-263;

11. R.R. Dogonadze, A.A. Kornyshev, A.M. Kuznetsov and T.A.

Marsagishvili. "Aspects of Electrodynamics of Electrochemical Systems". J.Phys. (Paris), Colloq., 1977, pp. 35-48;

12. R.R. Dogonadze and A.M. Kuznetsov. "Kinetics and Catalysis. Kinetics of Heterogeneous Chemical Reactions in Solutions". Publishing House of VINITI, Moscow, 1978, 223 pp. (a monograph. In Russian);

13. R.R. Dogonadze. "Theory of Molecular Electrode Kinetics".- N.S. Hush (Ed.). Reactions of Molecules at Electrodes. Interscience, London, 1971, pp. 135-227 (a monograph);

14. R.R. Dogonadze, A.M. Kuznetsov and T.A. Marsagishvili. "The Present State of the Theory of Charge Transfer Processes in Condensed Phase". J.Electrochem.Acta, 25 (1980), pp. 1-28;

15. R.R. Dogonadze and T.A. Marsagishvili. "Electrodynamics on Electrochemical Systems: Application to IR and Optical Transitions in Systems Containing Impurities". J. Surf.Sci., 101 (1980), pp. 439-461;

16. R.R. Dogonadze and A.M. Kuznetsov. "Quantum Electrochemical Kinetics: Continuum Theory".- B.E. Conway, J.O'M. Bockris and E. Yeager (Eds.). Comprehensive Treatise of Electrochemistry. Vol. 7, Plenum Press, New York, 1983, pp. 1-40;

17. R.R. Dogonadze, G.M. Chonishvili and T.A. Marsagishvili. "Quantum Theory of Charge-Transfer Processes". J. Chem.Soc., Faraday Trans. 2, 80 (1984), pp. 355-364;

18. R.R. Dogonadze, A.A. Kornyshev and J. Ulstrup. "Theoretical Approaches to Solvation".- R.R. Dogonadze, E. Kalman, A.A. Kornyshev and J. Ulstrup (Eds.). The Chemical Physics of Solvation. Part A, Ch. 1. Elsevier, Amsterdam, 1985, pp. 3-35;

19. R.R. Dogonadze and T.A. Marsagishvili. "Methods of Quantum Field Theory in Electrodynamics of Solvation".- R.R. Dogonadze, E. Kalman, A.A. Kornyshev and J. Ulstrup (Eds.). The Chemical Physics of Solvation. Part A, Ch. 2. Elsevier, Amsterdam, 1985, pp. 39-76.

20. Yu.G. Boroda, R.R. Dogonadze and T.A. Marsagishvili. "Theory of the Elementary Act of Electrochemical and Photoelectrochemical Nonadiabatic Charge Transfer Processes".- Elctrodynamics and Quantum Phenomena at Interfaces. Proceedings of the International Conference (Telavi-1984. In English). Publishing House "Metsniereba", Tbilisi, 1986, pp. 299-305;

21. R.R. Dogonadze, T.A. Marsagishvili, M.G. Zakaraya and J. Ulstrup. "Solvent dynamic effcts on excitation profiles for resonance Raman Scattering".- Electrodynamics and Quantum Phenomena at Interfaces. Proceedings of the International Conference (Telavi-1984. In English). Publishing House "Metsniereba", Tbilisi, 1986, pp. 419-424;

22. R.R. Dogonadze. "Quantum Theory of Chemical Reactions in Polar Liquids".- Quantum-Mechanical aspects of Electrochemistry. Proceedings of the IV Session of International Summer School (August 19-30, 1985, Ohrid - Jugoslavja). Skopje, 1987, pp. 1-84.

23. R.R. Dogonadze and Z.D. Urushadze. "Introduction in the Quantum Theory of Kinetics of the Elementary Act of Biochemical Processes." 100 pp. (a monograph. In Russian, English summary). – http://www.archive.org/details/VvedenieVKvantovo-mekhanicheskuyuTeoriuKinetikiElementarnogoAkta, 2008.

LITERATURE ABOUT PROFESSOR REVAZ R. DOGONADZE:

1. Revaz Dogonadze Memorial Issue of the International Journal "Electroanalytical Chemistry and Interfacial Electrochemistry", Vol. 204, 1986.

2. A.M. Kuznetsov. "A Tribute to Professor Revaz R. Dogonadze: The Man and His Works."- International Journal "Progress in Surface Science", Vol.20, No:1, 1985, pp. 1-7.

3. Z.D. Urushadze. "Professor Revaz Dogonadze." Publishing House "Tsodna", Tbilisi, 1986, 30 pp. (In Georgian).

4. "Founder of Quantum Electrochemistry." Compiler: Prof. Z.D. Urushadze. Publishing House of the Tbilisi State University, Tbilisi, 1991,

141 pp. (In Russian).

PROMINENT PERSONS ABOUT PROFESSOR REVAZ R. DOGONADZE:

M. Voinovich and R.R. Dogonadze

"I joined his group in Moscow. All through winter and spring, I worked hard, exploring new areas of science with him. In the summer he took my wife and me to Georgia, where we were received with the proverbial hospitality of his people... Prof. Dogonadze's place is assured in the future textbooks of Electrochemistry, and in the hearts of those who knew him." (Professor Wolfgang Schmickler, Germany).

"I first knew of Professor Dogonadze's accomplishments more than twenty-one years ago when, as a graduate student, I came to grips with his papers on the electron transfer theory. That was the Dogonadze (in print) of "Levich and Dogonadze" about whom so much had been talked and weitten

about. Their work, and Marcus' independent contributions, was causing a well-deserved stir in the communities of both electrochemists and inorganic chemists. I felt rather small working in the shadow of these people." (Professor P. Schmidt, USA, 1990).

"I have had the good fortune of being granted to work with Professor Dogonadze and enjoy his inspiration and friendship over a span of fourteen years. In crucial ways this has been a guideline and paved the way for my scientific undertakings. But like a cello which also gives off a whole spectrum of overtones when struck, so are the memories of Rezo's colleagues and students enriched also by numerous stronger and weaker overtones which relate to Rezo's impact on many facets of their lives. We recall Rezo as the brilliant scientist, as the scintillating lecturer, and as the careful tutor." (Professor Jens Ulstrup, Denmark).

"It was with a sense of shok that we learned about the untimely death of our colleague Rezo Dogonadze. One of us (R.A.M.) met Rezo only infrequently - and not since 1971 - but his cheerfulness and the depth of his insight so evident in his work will always be remembered. Nowadays, in the electron transfer field to which Rezo devoted so much of his interest, there have been an increasing number of studies on the possible extent of solvent dynamics effects on some electron transfer rates. The work has been both experimental and theoretical. Although Rezo's bent was often towards the quantum side of the electron transfer, his interest in relaxation was evident, and we could well have imagined his plunging into this new area." (Prof. R.A. Marcus, USA and Prof. H. Sumi, Japan, 1986).

"Fundamental concepts for a theoretical description of electrode reactions were developed by Butler and Volmer, and Gurney and Marcus. Our understanding, however, is based mostly on the subsequent quantum-mechanical approach to electrochemistry which was developed by Rezo Dogonadze. That was clearly demonstrated by the Conference in Telavi which was organized by Rezo Dogonadze himself just before his sudden death. Electrochemists mourn the death of this excellent scientist and good friend." (Prof. J.W. Schultze and Dr. L. Elfenthal, Germany, 1985).

"Professor R.R. Dogonadze provided electrochemists with theoretical tools

and insight, and encouraged also experimentalists to unravel fundamental dynamics in electrochemical and photoelectrochemical systems". (Dr. K. Bitterling and Dr. E. Willig, Germany).

"Prof. R.R. Dogonadze's fundamental contribution to chemistry lies in the creation of a consistent quantum-mechanical theory of charge transfer reaction in condensed media. One of the basic concepts of the theory is the idea of quantum and classical degrees of freedom and their appreciably different behaviour during the elementary act. The conclusion about the prevalence of a purely quantum subbarrier proton transfer without preliminary stretching of its covalent bond was absolutely unexpected for the majority of chemists". (Prof. L.I. Krishtalik, Russia).

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Z.D. Urushadze & R.R. Dogonadze (Moscow, 1957)